

Adrenal Vein Sampling

Indications

This test is *only* appropriate if (1) biochemistry points to hyperaldosteronism and (2) if the patient is for active consideration of surgery.

Sampling right and left adrenal veins can differentiate between unilateral or bilateral disease.

Contraindications

- High bleeding risk
- Accelerated hypertension
- Significant ischaemic heart disease
- Allergy to contrast
- If patient is taking warfarin and INR >2.5

Side effects

- Bleeding
- Adrenal infarction or haemorrhage
- Venous thrombosis
- Groin haematoma or infection

Preparation

For this test to be valid it is important that the following steps are followed meticulously.

The Endocrinologist will have overall responsibility for organising the following in conjunction with interventional radiology and biochemistry:

1. Book a date (Monday – Thursday) but consideration of the medication washout period will need to be taken into account (see (6) below).
2. Contact the Duty Clinical biochemist on extn 48437 or by email to Dr Nathan Cantley (Nathan.cantley@nbt.nhs.uk) to make them aware of the date. It is essential to let the laboratory know as they need to organise laboratory support for the procedure.
3. Endocrinologist should order 250mcg synacthen and 500mls 5% dextrose from pharmacy - prescribe on an IP drug chart and take to pharmacy. Please confirm with pharmacy that this will be available for the procedure.

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4. If the biochemist is unable to help with preparatory requesting on the laboratory system - request all the samples required on ICE. It is essential that clinical details are entered and that each sample alerts the laboratory that it is part of an adrenal vein sampling procedure. 3 cortisol and 3 aldosterone requests are required. Request a baseline U&E sample - to be taken with the first sample.
5. An information letter should be discussed with and given to the patient (see appendix 1) which will cover the following advice:

a) Discontinue drugs as follows:

Spironolactone, oestrogens	6 weeks
Diuretics	4 weeks
ACE Inhibitors and NSAIDs	2 weeks
Calcium antagonists	1 week
Sympathomimetics	1 week
Beta-blockers	1 week
Avoid Liquorice	

If anti-hypertensive therapy needs to be continued then doxazosin or verapamil may be used. Consider home BP monitoring if concerned that the blood pressure may elevate in the interim.

Steroids may suppress endogenous cortisol and aldosterone so they should ideally be stopped but this should be reviewed by consultant endocrinologist.

b) Sodium intake:

Patient should not be on a restricted sodium intake before admission.

c) Exclude hypokalaemia:

1. Arrange a blood test with the local GP 2-3 days before the procedure. Check FBC, U&E, INR (as guided by interventional radiology/patient medication history).
2. The bloods should be reviewed ahead of time by the endocrine team or biochemistry team. If the potassium is <3.0mmol/L then potassium supplements should be prescribed.
3. It is essential that the potassium is normal during the procedure and therefore a recent U&E is essential. If the blood cannot be tested for any reason 2-3 days prior to the procedure or there is hypokalaemia on the blood test this will need to be discussed with the endocrinology team in advance.
4. If the INR is measured and is >2.5 discuss with radiology – the need for an INR will be dependent on the medication advice.

d) Day of the procedure:

No requirement to fast and can take usual medication beforehand.
Patient to attend as per the TCI letter sent out by radiology booking.

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Consent will be done by the Consultant Radiologist on the day.

7. Results will be collated by Biochemistry and sent to respective endocrinology consultant to be discussed with the patient at their next appointment. *Please make sure they have a follow up appointment*

Procedure

1. The clinical scientist/biochemistry team will oversee the sample handling. They will attend radiology on the morning of the procedure to be present for WHO checklist Check-in point. They should review potassium result from 2-3 days earlier and if the patient was hypokalaemic but started on supplements consider an urgent U&E to exclude ongoing hypokalaemia after discussion with the endocrinologist. If the K remains <3.0mmol/L on the morning of the procedure, the consultant endocrinologist should be urgently informed.
2. The clinical scientist will ensure requests are ready from ICE/winpath with sample tubes labelled clearly ready.
3. The clinical scientist should use a sampling work sheet which will accompany the samples to the lab. They will ensure that each one clearly identifies the patient and the site it was taken from.
4. 250mcg synacthen will be prepared for 500mLs 5% dextrose and infuse intravenously at a rate of 100mL/h. This will deliver an infusion of 50mcg synacthen per hour. It will be commenced 30 minutes prior to sampling and continued throughout the procedure. This aims to minimise stress induced fluctuations in aldosterone, increase the gradient in cortisol between the adrenal vein and inferior vena cave in order to aid confirmation of successful catheterisation, and to maximise secretion of aldosterone to aid detection.
5. The adrenal veins are catheterised under X-ray control via femoral vein access. Positioning of the catheter is assessed by venous angiograms before and after selective blood withdrawal. A sequential sample is taken for cortisol and aldosterone from left and right adrenal veins and inferior vena cava.
6. A 5mL draw and discard should be performed if there is any drip used to keep the catheter patent. An 8-10mL blood draw minimum should be aimed for to ensure adequate sample for both the cortisol and renin/aldosterone samples.
7. The clinical scientist will take all samples to the laboratory as soon as the procedure has been completed. Ideally samples should be centrifuged and frozen within 1 hour but up to 4 hours is acceptable. They will need to oversee the labelling and processing within the laboratory (see worksheet). If there is a

delay of more than 1hr between sampling sites, samples already collected should be returned to the lab for processing.

8. Following the procedure the patient must remain in the day case ward adhering to trust standard procedures following a venous puncture IR procedure and follow after care procedures as advised by interventional radiology.

Interpretation

The cortisol levels are used as a guide to ensure that the adrenal veins have been successfully cannulated. The adrenal/IVC cortisol ratio is typically more than 10:1 in the context of a continuous synacthen infusion but must be at least 5:1 to confirm successful adrenal vein cannulation.

The diagnostic accuracy is improved by calculating corrected ratios and the aldosterone/cortisol ratio of the high side should be divided by the aldosterone/cortisol ratio of the low side. This corrects for dilutional effects of the inferior phrenic vein flowing into the left adrenal vein and, if sub-optimally sampled, of IVC flow into the right adrenal vein.

Corrected ratios of >4:1 are diagnostic and ratios >3:1 are possibly suggestive of an aldosterone producing adenoma. A ratio <3:1 is suggestive of bilateral aldosterone hypersecretion.

Sensitivity and specificity

The main challenge with this procedure is difficulty in catheterising the right adrenal vein. This is because the catheter enters the inferior vena cava at an acute angle and may be multiple.

In patients in whom both adrenal veins are successfully cannulated using the above cut offs AVS has a sensitivity of 95% and a specificity of 100% for detecting unilateral aldosterone hypersecretion.

References

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We acknowledge the Endocrinology Handbook. Imperial College Healthcare NHS Trust. March 2012 Edition.

Appendix 1 - Patient Information sheet

Introduction

You have been diagnosed with having a high aldosterone level which is a hormone produced by your adrenal glands and causes high blood pressure. In order to decide whether this hormone is coming from one or both adrenal glands your consultant has asked for adrenal vein sampling to be arranged.

What to expect

This test involves coming into to Southmead hospital in Bristol for the morning so that special x-rays and blood samples can be taken from the adrenal veins. We will need you to come in to Gate 19 on level 2 (Interventional X-ray day case).

Please attend on.....(date) at(time)

You may eat and drink as normal beforehand and you may take your usual medication.

You will meet the X-ray doctor (radiologist) and laboratory specialist who will be performing the test. You will have the opportunity to discuss the procedure with the radiologist who will ask for your signed consent to proceed with the test.

The procedure

You lie on a bed in an X-ray room. A small plastic cannula (tube) will be placed into one of the veins in your hand. Throughout the procedure you will be given a drip through this cannula which will contain synacthen. This is a medication which will help stimulate the adrenal glands.

An X-ray machine is mounted above the bed. A catheter (a fine plastic sheath) is inserted through a wide needle into a blood vessel in the groin. Local anaesthetic is injected into the skin above the blood vessel. Therefore, it should not hurt when the catheter is passed into the blood vessel. The catheter is moved through the veins towards the adrenal veins.

An X-ray dye (Iodinated contrast) is injected to map out your veins and low-dose X-rays are used to monitor the progress of the catheter tip and to tell when it is in the correct place. You may be able to see the progress of the catheter on the X-ray monitor. Once the catheter is in the right and left veins a blood sample will be taken from both sides.

When the test is over, the catheter is gently pulled out. Pressure will be applied over the site of insertion for about 10 minutes to prevent any bleeding.

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After the procedure you will need to stay in the day unit a number of hours. You will need to arrange for someone to collect you following the procedure and you should rest for that day. The wound is small, like after giving blood, and does not require any specific dressings.

The samples are sent away to be analysed and the results take several weeks to come back so will be discussed with you at your next appointment.

Risks of the procedure

This is usually a very safe procedure but rarely there is the risk of infection, bleeding and failure to obtain the samples. There is a very small risk of an allergic reaction to the synacthen medication but you will be monitored throughout and the risk is estimated to be less than 1%.

Before the procedure

In order for the test to give reliable results there are many factors which need to be closely controlled and therefore it is really important that you follow the steps below:

1. Changes to your medication

You will need to stop the following tablets:

Stop.....on (date)..... (..... weeks before test)

Stop.....on (date)..... (..... weeks before test)

Stop.....on (date)..... (..... weeks before test)

Stop.....on (date)..... (..... weeks before test)

Stop.....on (date)..... (..... weeks before test)

Stop.....on (date)..... (..... weeks before test)

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2. Blood pressure control

As your blood pressure will still need to be controlled, your Consultant may wish to start an alternative tablet or get you to measure your blood pressure at home. They will document their advice below:

3. You should NOT avoid sodium (salt) intake. An adequate salt intake is essential.

4. Potassium blood test

Please book an appointment with your GP 2-3 days before the procedure.
The day after your blood test please telephone your Consultant,
Dr.....on telephone number.....to
discuss the results.
If you have low potassium levels you may require a supplement for a few days.

**Please make sure your potassium result is written in here.....mmol/L
and please bring this sheet with you on the day of the procedure.**

**If you have any further questions please feel free to discuss with
your Endocrinology Consultant.**

Name.....

Telephone number

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Appendix 2 - Worksheet

Please print off these guidelines and use the worksheet to keep a record of which site the samples have been taken from.

	3x Li-Heparin	3x EDTA
Right Adrenal Vein	Cortisol Time: Sample No: Specimen No:	Aldosterone Time: Sample No: Specimen No:
Left Adrenal Vein	Cortisol Time: Sample No: Specimen No:	Aldosterone Time: Sample No: Specimen No:
Inferior Vena Cava	Cortisol Time: Sample No: Specimen No:	Aldosterone Time: Sample No: Specimen No:

Laboratory processing

1. The duty clinical biochemist/Dr Nathan Cantley will be informed in advance of the procedure date. They will be responsible for discussing with the DCB team and allocating a person to attend. The assisting clinical biochemist will need access to ICE.
2. The assisting clinical biochemist needs to adhere to the adrenal vein sampling policy during the procedure (DS/CB/DCB/EN/22). They should bring the samples direct to the laboratory as soon as possible after the procedure.

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3. They must make sure the samples are clearly labelled with the patient I.D, the site the sample was taken from and that the correct laboratory specimen labels are applied.
4. **They must make sure that the cortisol is measured by NBT laboratory on the samples they bring back to the lab** but also sent with the Aldosterone specimens to Charing Cross hospital as a marked aliquot. (The SAS Laboratories, Clinical Biochemistry & Medical Oncology, Charing Cross Hospital, London, W6 8RF)
5. The samples will require sending frozen. Making the aliquots and freezing should be supervised to make sure samples are sent correctly. The Clinical scientist must fill in a request sheet to include the clinical details and clearly identify the samples as from an adrenal vein sampling.
6. Duplicate aliquots for each sample should be made and stored in the send-away freezer for reference.
7. The biochemist should telephone or email the send-away laboratory to let them know the samples have been sent (imperial.reninaldo@nhs.net).
8. The worksheet should be scanned onto the request DART viewer for future reference.
9. The lead biochemist should complete the report for the results and share with endocrine and radiology teams once available, uploading to the patient record of EDMS when completed.